National, Regional, and International Standards and Comparisons

Program Manager: E Clayton Teague
Total FTE: 2.42
Total Funding: $445,000

Goal

Provide leadership and technical input to realize strong representation of U.S. interests and technology at national, regional, and international standards organizations in mechanical metrology and advanced manufacturing technology.

Program Objectives

FY2000

Lead national efforts in formulating preliminary working specifications and documents as drivers or major source documents for developing national and international standards in all mechanical metrology and manufacturing technology topics within the Division mission.

Administration of ISO/TC39/SC2 International Machine Tool Test Conditions Standards

Provide leadership in the development of international standards on machine tool performance evaluation by acting as the secretariat of ISO/Technical Committee (TC) 39/Sub-Committee (SC) 2: International Machine Tool Test Conditions Standards. Consistently represent U.S. interests in the ISO arena and efforts to harmonize U.S. and international standards.

National Machine Tool Standards

Provide leadership in the development of U.S. National Standards on the performance evaluation of machine tools by providing technical support and input to the American Society of Mechanical Engineers (ASME) Technical Committee (TC) 52 (B5/TC52). Work to standardize information models and associated data formats for machine tool performance data.

Mass Standards

Provide leadership, advocacy, technical support, and input for the U.S. in the development and adoption of national and international standards in the area of mass.

Force Standards

Provide leadership, advocacy, technical support, and input for the U.S. in the development and adoption of national and international standards in the area of force.

Mechanical Vibration and Shock Standards

Provide leadership, advocacy, technical support, and input for the U.S. in the development and adoption of national and international standards in the areas of mechanical vibration and shock through the American National Standards Institute (ANSI) accredited Standards Committee on Mechanical Vibration and Shock, S2 and ISO TC 108 and its six subcommittees.

Acoustics Standards

Provide leadership, advocacy, technical support, and input for the U.S. in the development and adoption of fundamentally important national and international standards in the areas of acoustics. To leverage NIST efforts by close coordination and cooperation with ANSI accredited Standards Committees S1 Acoustics, (especially its Working Group (WG) 1) and S3 Bioacoustics, the principal components of the U.S. TAG (Technical Advisory Group) for International Electrotechnical Commission (IEC) TC 29.

Ultrasonics Standards

Provide leadership, advocacy, technical support, and input for the U.S. in the development and adoption of national and international standards in the area of ultrasound power calibrations and reference standards.

Optical Standards

Develop standards for interferometric testing of advanced optics through participation in ISO TC 172/SC1 and through Optics and Electro-Optics Standards Council (OEOSC) - the U.S. shadow body for the ISO technical committee.

Reference Temperature Standards

Provide leadership to develop revision of ISO 1 and ISO Technical Report 16015 on uncertainties when measurements are made at other than the reference temperature of 20 C.

Smart Transducer Interface Standards IEEE 1451

Convene with industry to develop Smart Transducer Interface Standard Institute of Electrical and Electronic Engineers (IEEE) 1451.

FY2001

Based on the standards measurement strategies being developed by NIST and the Manufacturing Engineering Laboratory (MEL), the Automated Production Technology Division (APTD) will conduct a careful review of its present standards committee and working group participation and adopt a Division-wide approach to address the demands for upcoming documentary standards needs in mechanical metrology and manufacturing technology.

FY2003

Develop instrumentation and procedures for mass at the national level parallel to that for the international comparisons to enable the collaboration, comparison of measurements, and data analysis to complete national key comparisons and achieve improved uniformity of weights and measures throughout the States.

National Key Comparison in Mass

Link together, formally for the first time, the whole United States legal metrology system for mass.

FY2005

To the degree of adoption that can be achieved within the respective Consultative Committees and SIM (Sistema Interamericano de Metrologia) Working Groups, for mass, force, acceleration, sound pressure, and ultrasonic power, develop instrumentation and establish procedures by which full audio and video collaboration and comparison of measurements can be conducted via the Internet to achieve a streamlined process of conducting key international comparisons and SIM comparisons.

FY2010

Complete all procedures and analyses to achieve mutual recognition of NIST measurement standards and calibration certificates by major countries in SIM and those countries that are members of the Convention of the Meter to ensure traceability and comparability of U.S. standards in mechanical metrology and manufacturing technology to those of other nations.

International Comparison of Load Cell Testing in Accordance with Organization for International Legal Metrology (OIML) R60 Procedures

Improve the position in the global market of U.S. manufacturers of load cells used in weighing systems through the removal of technical barriers to free trade.

Regional and International Comparisons in the Area of Force

Improve the position in the global market of U.S. manufacturers of force measuring equipment through the removal of technical barriers to free trade.

Regional and International Comparisons in the Area of Mass

Improve the position in the global market of U.S. manufacturers dependent on mass metrology through the removal of technical barriers to free trade.

Regional and International Comparisons in the Areas of Acoustics, Ultrasound, and Vibration

Complete critical international key comparisons in acoustics, ultrasound, and vibration, and thereby prevent or remove technical barriers to free trade.

Customer Needs

This program is motivated by the need for NIST, the Manufacturing Engineering Laboratory (MEL), and the Automated Production Technology Division (APTD) to represent U.S. interests more strongly in all major international standards organizations. This need results from the increased use of standards and conformity assurance testing as a means to control international trade by major regional trading blocks. Efforts to remove technical barriers to international trade dictate careful documentation of measurement traceability and harmonization of standards and performance tests within and across trading blocks. In these standards organizations and on many other international fronts, standardization activities are increasing rapidly. The growing number of international standards resulting from these activities are impacting heavily upon the formulation of U.S. standards and the global marketability of U.S. industrial, health, and safety products. Four examples of greatly increased activity over the last ten years which directly or indirectly require increased effort by NIST, MEL and APTD are: (1) legal metrology standardization - impact of the Organization for International Legal Metrology (OIML), (2) institution of key international comparisons to achieve mutual recognition of measurement standards and calibration certificates by all participating National Metrology Institutes (NMIs), (3) growing demands for electromagnetic compatibility (EMC) (i.e., susceptibility to electomagnetic interference (EMI), emission of EMI, or both) of devices, and (4) growing demands for compliance with the environmental standards of ISO 14000.

NIST's APTD needs to lead in formulating standards and in providing the scientific and engineering bases as standards are being developed. Such support for standards development will enable the US to be in a technically and politically strong position through tightly coordinated national efforts and sustained support of U.S. representatives on ISO, IEC, and OIML committees, subcommittees, and working groups. Over the last ten years, the U.S. has in many instances not done so, and as a result has allowed international standards that affected future U.S. health, safety, and economic well-being to be written by other nations, primarily Western Europe. NIST Director Ray Kammer recently observed that "standards organizations in Western Europe have not done something evil. They are smarter than we are. They realize that in the future standards are going to be a strong influence on what people buy because companies want to manufacture one product and sell it worldwide. They realize that as the emerging markets come into world trade they are unsophisticated and their natural impulse is to use the international standard."

To facilitate the task of achieving traceability across trade blocks, the directors of the NMIs, in cooperation with the International Bureau of Weights and Measures (BIPM), have developed an arrangement for mutual recognition of national measurement standards and calibration certificates issued by the NMIs. Recently regional trading blocks such as the European Union (EU), the North American Free Trade Agreement (NAFTA), and the Asia Pacific Economic Cooperation (APEC), have also begun to organize block-wide metrological activities to assure themselves of uniformity of measurements within their region/trading block. The EU has closely

coordinated standards activities through their European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC). The U.S. is a partner in NAFTA and also in SIM. It is also active in some of the APEC activities. But in none of these trade blocks of which the U.S. is a member is there the same degree of coordination as there is in the EU.

There are four major international organizations that develop voluntary standards; the International Standards Organization (ISO), the International Telecommunication Union (ITU), the International Electrotechnical Commission (IEC), and OIML. To achieve the goal of this program several major issues have to be recognized and addressed. Issue 1: The European community representatives on various ISO and IEC committees often develop their own regional European draft standard and then vote as a block to introduce one of their CEN standards at an advanced stage of development as a draft ISO (or IEC) document. This effectively deprives non-European countries such as the U.S. and Japan of full participation in the development of these ISO and IEC standards. Issue 2: Up until the last several years there often existed serious technical gaps between ISO and U.S. standards typically generated by a history (over decades) of U.S. standards organizations giving little attention to differences that existed between U.S. and ISO activities. In other instances there are just serious differences which require great effort to reach an acceptable solution - sometimes ongoing over many years. Issue 3: There are often very disparate categorizations of U.S., IEC, and ISO standards and supporting documents that can lead to major problems in attempts by U.S. representatives to incorporate U.S. standards into IEC and ISO standards.

Technical Approach

To address this broad scale need, we will achieve the objectives by working with standards bodies, national and international, to improve the underlying tools, both procedural and electronic, as members and sometimes leaders in standards working groups and committees, to work to streamline the process of developing standards, and conduct international comparisons. Based on the standards measurement strategies being developed by NIST and MEL, APTD will conduct a careful review of its present standards committee and working group participation and make a Division-wide analysis of the most important demands for upcoming documentary standards needs in mechanical metrology and manufacturing technology. Once specific areas have been identified and chosen, we will: begin the process of researching the scientific and technical background in this area, develop a working knowledge of the proposed area, and work with industry to draft initial standards based on workshops targeted to get inputs from industry. Efficient procedures for developing the initial working standard will be based on improving communications among working group members by the use of web home pages and/or email exploders or other approaches. Streamlining the conduct of international comparisons will be explored through the development of instrumentation and methods to enable full utilization of the Internet for real-time audio, video, shared software applications and mutually accessible databases by all participants.

Standards Participation

	Mass	Force	Acceleration	Acoustics	Ultrasonics	Manufacturing Technology
National Standards	- ASTM E41.06 Weighing Devices	- ASTM E28 Mechanical Testing	- ANSI S2 Mechanical Vibration & Shock (Chair) WG81 Calibration & Use of Instruments (Chair) - ANSI/ASA US TAG for ISO TC108 (Chair) - SC3 Use and Calibration of Mechanical Vibration & Shock Measuring Instruments (Chair)	- ANSI/ASA S1 Acoustics - WGs 01(Chair),WG16 FFT Acoustical Analyzers - WG21EMS of Acous. Instrum. - WG24 Des. Resp. Weighing Networks for Acous. Meas. - ANSI/ASA S3 Bioacoustics WG37 Earphone, WG48 Hearing Aids, WG80 Probe Measurements - ANSI/ASA S12 Noise - WG19 Meas. of Occupational Noise Exposure - SAE Emer. Warning Devices - SAE Emergency Vehicle Siren Task Force - ASA C1 (Ex-Officio)	- ASTM E7.06 Ultrasonic Nondestructive Testing - ASTM E28 Mechanical Testing, E28.05 Residual Stress, E28.13 Dynamic Modulus Measurements	- ANSI/ASME B5 Machine Tools - ANSI/ASME B5/TC52 Machining & Turning Centers - ANSI/ASME B89.3.4 Axes of Rotation - EIA/IE 31 Numerical Control - IEEE P1451 Smart Transducer Interface for Sensors & Actuators; P1451.1, .2, .3, & .4 WGs - IEEE IMS TC9 Sensor Tech. - ANSI/OP Optics and Electro-Optical Instruments
SIM/ NORAMET	- Pilot lab for 1 mg – 1 kg SIM comparison - Planning SIMnet comparison in mass	- US Technical Contact for Mechanical quantities	- Pilot Lab for Comparison on accelerometers	- Participant in Comparison on Microphones		
OIML	- OIML SC3 TC9 Inst. For Measuring mass & density	- OIML SC3 TC 9 US TAG WG on Load Cells - CoPilot Lab APEC IC R60 Load Cell Evaluation		- US National WG for OIML TC 13 Measuring Instruments for Acoustics and Vibration (Technical Advisor)		
BIPM Key International Comparisons (KIC) CCs & CC WGs	- Participant in KIC in range 100 g to 10 kg - CCM WG on Mass & Density	- CCM WG on Force - Pilot Lab for one of four KIC on force by CCM	- Planning KIC Vibration (2000) by CCAUV	- Participant in KIC Airborne Acoustics (2000) by CCAUV	- Participant in KIC U/S Power (2000) by CCAUV	
ISO/IEC	Not generally applicable	Not generally applicable	- ISO TC 108 Mechanical Vibration & Shock - SC3 Calibration; WG6 Calibration of Vibration & Shock Pickups (US Expert); WG10 Vibration condition monitoring transducers and instrumentation (US Expert) - WG 26 Sig. proc. methods for anal. of stat. mech. vib. (conv.) - WG 27 Sig. proc. meth. for non-stationary mech. vib & shock (US Expert)	- IEC TC 29 Electroacoustics, WG5 Measurement Microphones - US National Committee for IEC (Member, as Technical Advisor for TC29 Electroacoustics)	- ISO TC 135/SC3 Acoustic Methods (Liaison to IEC) - US TAG for ISO TC 135 Nondestructive Testing	- ISO TC39 Machine Tools - TC39/SC2 Test Conditions for Machine Tools (Secretariat) - TC39/WG6 Thermal Effects on Machine Tools (Convener) - ISO TC 172 Optics & Optical Instruments - ISO TC 213 WG 3 Dimensional & Geometrical Product Specifications; Ref. Temperature WG - TC 184/SC4 Industrial Data

Accomplishments

- November FY2000 Initiated communications with the ASME B5 committee and industry on the establishment of a Technical Committee on information standards for machine tools. The completed draft of the "Data Specification for Machine Tool Performance Tests", a.k.a. the Data Dictionary, will be considered by this committee. The specification identifies and defines the properties and results of machine tool performance tests to form the basis of a common presentation. The draft covers most of the machine tool performance tests mentioned in the B5.54 and B5.57 standards.
- September FY1999 Continued effective execution of ISO/TC39/SC2 Secretariat functions that included:
  - Maintaining 60 international standards on machine performance evaluation.
  - Organizing one meeting in Kyoto, Japan and completing preparations for the second meeting, which was held in October 1999.
  - Produced six Final Draft International Standards, three Draft International Standards (DIS) and three Working Draft (WD) Standards.
  - Compiled comments from member countries and developed Secretariat responses for those comments for nine draft international standards.
  - Carried out the five yearly systematic reviews of ten international standards.
  - Solicited and complied US national comments for the three DIS and three WD draft standards and presented them to SC2 in the international meeting.
- September FY1999 Leadership or participation in ASME B5 Technical Committees and Working Groups
  - five Working Groups of ASME technical committee 52 (B5/TC52)
  - Participated in all three meetings of the Working Group on machine tool performance.
  - Reviewed galleys for the new B5.57 Standard on turning centers.
  - Reviewed a large number of proposed revisions to the B5.54 standard on machining centers and provided comments and corrections.
  - Prepared a rewritten section on geometric accuracy tests for the B5.54 standard.
  - Prepared a document detailing a proposed restructuring of the American B5 standards on machine tool performance evaluation.
- September FY1999 Completed an extensive series of experiments on a variety of machine tools to assess the differences between the positioning accuracy as determined by the definitions in various machine tool standards (VDI, JIS, B5.54, B5.57, ISO230-2:1988, and ISO230-2:1997).
- September FY1999 Attended and contributed to the ISO TC172/SC1/WG1 meeting in September, 1999 (Japan). Working Group 1 is in the process of drafting an international standard on interferometry.
- August FY1999 Developed and presented NIST positions on new comparisons and technical protocols at the Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV) meeting at BIPM, completed NIST measurements for the first International Committee of Weights and Measures (CIPM) /CCAUV key comparison CCAUV.A-K1 of standard microphone pressure-response calibration in acoustics, and

completed measurements as pilot laboratory for the first SIM regional comparison of vibration calibration.

- May FY1999 Tested a new measuring device for contouring tests, the laser/ball-bar. This device was proposed as an alternative to the telescoping ball bar, grid encoder, or precision disk mentioned in the B5 standards on machine tool performance evaluation.
- May FY1999 Attended and contributed to OEOSC and ANSI/ OP standards meetings in January, 1999 (San Jose) and May, 1999 (Baltimore). The ANSI/OP committee is actively developing a glass standard for the U.S.
- May FY1999 Provided timely and adequate U.S. technical positions on relevant IEC TC 29 (via USNC/IEC) and OIML TC 13 documents (via Dr. S. Chappell of NIST), led the U.S. delegations at meetings of both of these committees in Frankfurt, Germany, and leveraged NIST efforts by close coordination and cooperation with ANSI-accredited Standards Committees S1 Acoustics, S3 Bioacoustics, and their relevant working groups.